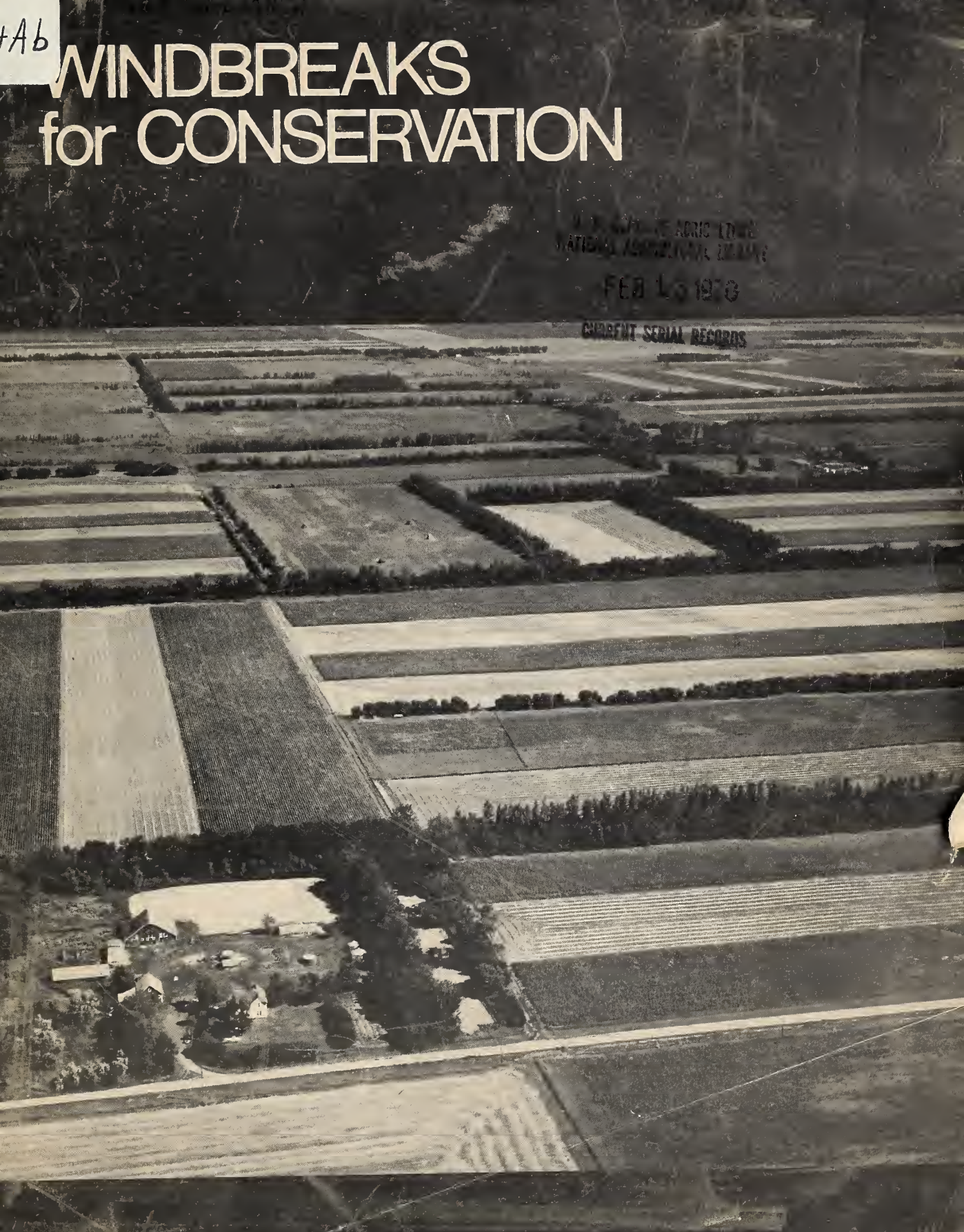
WINDBREAKS for CONSERVATION



U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE
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CONTENTS

This publication supersedes Miscellaneous Publication No. 759, Windbreaks in Conservation Farming.

Caution: Used improperly, herbicides can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels. Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Washington, D.C. Issued October 1969

WINDBREAKS for CONSERVATION

By Arthur E. Ferber, *regional forester,* Soil Conservation Service

TREES are nature's outdoor air conditioners. If hot summer winds, raw wintry blasts, wind erosion, or crop damage due to wind are problems to you, windbreaks can help if trees can be grown successfully in your area.

Where natural protection is lacking, windbreaks of trees and shrubs protect your home or farmstead against frigid storms and soil-blowing winds. Add to this the beauty, permanence, and homelike setting which trees bring to a home and community. The returns in comfort and economy far outweigh the cost.

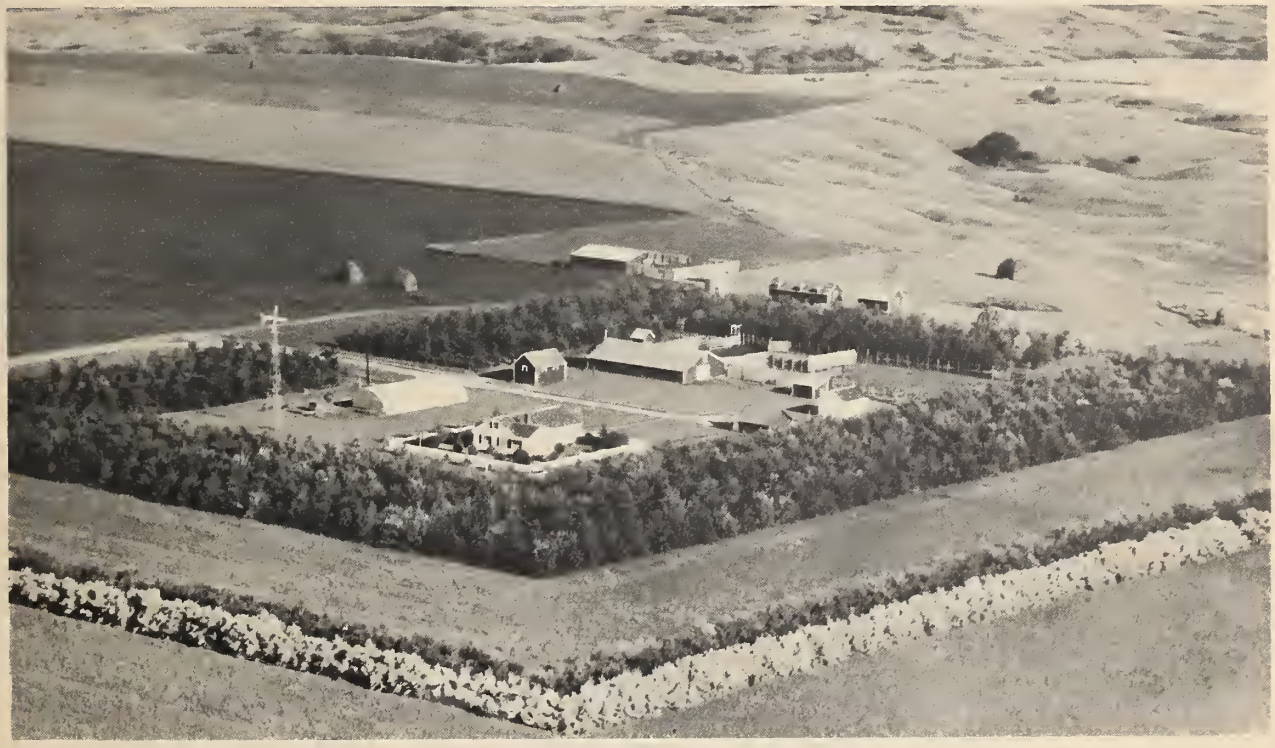
Conservation Values of Windbreaks

Windbreaks help people—to live more comfortably, to work more easily, and to improve their quality of living.

People in many areas find windbreaks useful. Farmers and ranchers in the United States have planted and benefited from them for many years. And they can be just as valuable to the country homeowner. Although windbreaks are found more often in the North and West than in the South and East, they are proving useful in almost every state—even in the Deep South.

Windbreaks help control soil blowing, reduce the drying effects of wind on soil and plants, and help prevent the abrasive action of rapidly moving soil particles on young tender seedlings.

Windbreaks in fields are most needed where wind erosion is a problem in parts of the vast Great Plains; on the sandy and muck soils in the Great Lakes region; on sandy soils along the Atlantic and Gulf seaboards; and in the irrigated valleys of the Pacific southwest and the Rio Grande, Colorado,



ND—792

A pattern of tree windbreaks protects this North Dakota farmstead.

and Columbia River basins.

During the winter, windbreaks trap snow that later melts, providing moisture for growing plants in spring and summer and contributing to groundwater supplies. They provide homes for insect-eating birds. Upland game birds and other wildlife use them for cover, food, nesting, and travel lanes. Bees and other pollinating insects find protection on the leeward side.

Windbreaks make sprinkler irrigation more effective. They protect the spray against shifting winds so that pipelines do not have to be reset as often. This gives a more uniform distribution of water.

Planted around country homes and farmsteads, windbreaks protect people, livestock, and yards from high winds, airborne dust, and drifting snow. They reduce health hazards due to pollution from dusty air. And they can help reduce noise from highways or other sources.

To reduce wind erosion

Fine soil particles, both organic and mineral, are easily moved by wind. Often the soil particles that blow from a field contain 10 to 20 times as much humus and phosphate as the heavier particles that stay on the field.

Soil particles do not ordinarily blow until wind velocity is about 13 miles per hour 1 foot above the ground. This is known as threshold velocity. Above

WIS–1405

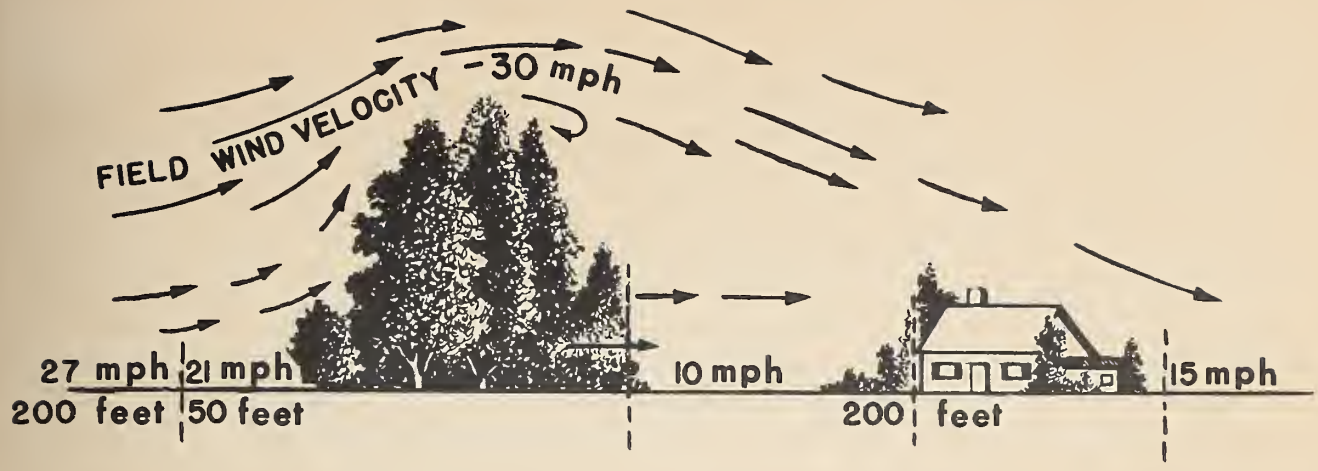
Fields of sandy soil in central Wisconsin are stabilized by evergreen windbreaks.

TEX–51,116

Despite a 25-mile-per-hour wind, this sprinkler irrigation system near Vernon, Tex., is in full operation due to windbreak protection. With no protection from the wind, the sprinkler would not apply water at a uniform rate.

MICH–61059

Field windbreaks of willow trees help this Michigan landowner protect his soil and crops.



Windbreaks reduce wind currents: Part of the air current is diverted over the top of the trees and part of it filters through the trees. Farmstead, livestock, and wildlife windbreaks should be relatively dense and wide to give maximum protection close to the trees. Field, orchard, and garden-type windbreaks need not be so wide and dense.

threshold velocity, the capacity of winds to carry soil is proportional to the cube of the wind velocity. Small reductions in wind velocity, therefore, cause a greater proportionate reduction in the rate of soil loss.

Soil from a large open field, where winds can get a good sweep, is more likely to blow than soil from a small one. And the damage often spreads to other areas. Windblown soil may fill irrigation and drainage ditches and pile up along fence rows and on roads. Blowing soil may even create highway driving hazards by limiting vision.

Wind erosion can be controlled in several ways. Among these are good plant cover, tillage practices that leave the soil ridged or cloddy, or windbreaks that reduce the wind velocity. Often a single measure is enough. But where erosion hazards are high, a combination of measures is needed.

Once windbreaks are well established, they protect fields all year. They provide full protection to an area 10 times the height of the trees measured in the direction the wind is blowing. And they give some protection as far out as 20 times the height of the trees.

For human comfort

Your skin, normally at a temperature of 91.4° F., loses heat quickly when there is a wind fanning it. The stronger the wind, the greater the cooling effect.

The following table is based on a study by U.S. Army research teams of the effect of wind on human skin surface in Antarctica and other places. A single number—called the wind-chill index—gives the combined effect of wind and temperature. A 30-mile-per-hour (mph) wind at a temperature of 10° F., for example, can cause the same heat loss from exposed skin as an equivalent temperature of −33° F. with no wind. A dense windbreak reduces a 30-mph wind to 10 to 15 mph. At 10° F., this means a change in chill index from −33 to about −13. Close to the windbreak, the chill index would be around 7.

Wind velocity	Wind-chill index for thermometer reading of—									
	50°F.	40° F.	30° F.	20° F.	10° F.	0° F.	−10° F.	−20°F.	−30° F.	−40° F.
Calm	50	40	30	20	10	0	−10	−20	−30	−40
5 mph	48	37	27	16	7	−6	−15	−26	−35	−47
10 mph	40	28	16	2	−9	−22	−31	−45	−58	−70
15 mph	36	22	11	−6	−18	−33	−45	−60	−70	−85
20 mph	32	18	3	−9	−24	−40	−52	−68	−81	−96
25 mph	30	16	0	−15	−29	−45	−58	−75	−89	−104
30 mph	28	13	−2	−18	−33	−49	−63	−78	−94	−109
35 mph	27	11	−4	−20	−35	−52	−67	−83	−98	−113
40 mph	26	10	−6	−22	−36	−54	−69	−87	−101	−116

NEB–2171

A beautiful Nebraska home is accented and protected by trees and shrubs. The sheltering tree windbreak helps to keep out drafts and dust.

To protect homes in open country

Windbreaks of trees and shrubs can beautify your home and its surroundings and make it a more pleasant place to live. Evergreens break the drab monotony of winter; broadleaf (deciduous) trees and flowering shrubs add color the rest of the year. Best of all, windbreaks protect the house and yard from freezing gusty winds, blowing soil, and drifting snow. In most parts of the country, cold winds cause more discomfort to man and animals than any other climatic factor.

Because of wind reduction, your home will be more comfortable. Home-fuel needs can be reduced 15 percent or more. And you will not have as much dust to clean up. By proper placement and planting of windbreaks, you can also control snowdrifting.

Shade trees, shrubbery, lawns, flowers, gardens, and family-size orchards are easier to establish and maintain if sheltered by a windbreak.

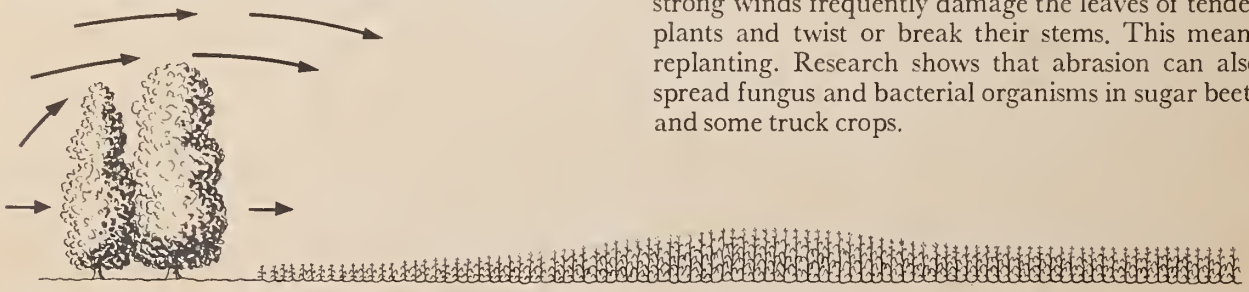
Windbreaks are often used by children as a place to play and romp. Some country homeowners use part of their windbreaks as a picnic area. (See Planning Windbreaks for Farmstead and Home, p. 11.)

To protect crops

Field windbreaks can take some of the risks out of farming wherever wind erosion is a hazard and where trees grow. Their use can increase the opportunities to farm more intensively and to grow crops that yield a higher income.

Yields on some crops may be lowered by gusty, hot winds. Strong winds blow crops to the ground before maturity, making them difficult to harvest.

Moving soil particles and the whipping action of strong winds frequently damage the leaves of tender plants and twist or break their stems. This means replanting. Research shows that abrasion can also spread fungus and bacterial organisms in sugar beets and some truck crops.



Often crop yields are lowest next to a tree windbreak. A common mistake is to observe only this area—the greatest gains are out a few more rods.

Though the effects of windbreak protection on crops have not been thoroughly tested, some results are available.

At Scottsbluff, Nebr., irrigated sugar beets were planted between rows of slatted fence 4 feet high and 50 feet apart and between two-row corn windbreaks similarly spaced. Beets in check plots without shelter produced 21.0 tons per acre; those sheltered by the fence rows, 24.1 tons per acre; and those by the corn rows, 26.5 tons per acre.

Agricultural scientists at a Canadian experiment station kept detailed records on wheatfields for a 5-year period. Fields protected by windbreaks showed a net increase of 0.7 bushel per acre as compared with those not protected. This takes into account the land used by the trees. The greatest increase occurred during the driest years.

In South Dakota some years ago, 331 farmers were asked about their experiences with field windbreaks. Of these farmers, 274 reported increased crop yields in 1 or more of the 3 years studied. They believed the increases were due to their windbreaks. They estimated an increase of 5 to 9 bushels of corn per acre on the parts of the fields protected by windbreaks and similar increases in other crops.

With good windbreaks, many cotton farmers in the sandy land of Texas and Oklahoma get cleaner, whiter cotton and less boll shedding. Their cotton grades higher and brings a better price. The lint is more nearly free of sand, and cotton picking need not be delayed because of high winds.

Narrow field windbreaks have been used for many years in the muck, peat, and sandy soils of the Corn Belt and the Northeast, the valleys of the Pacific Coast States, the Southwest, and other parts of the country to control wind erosion and protect crops.

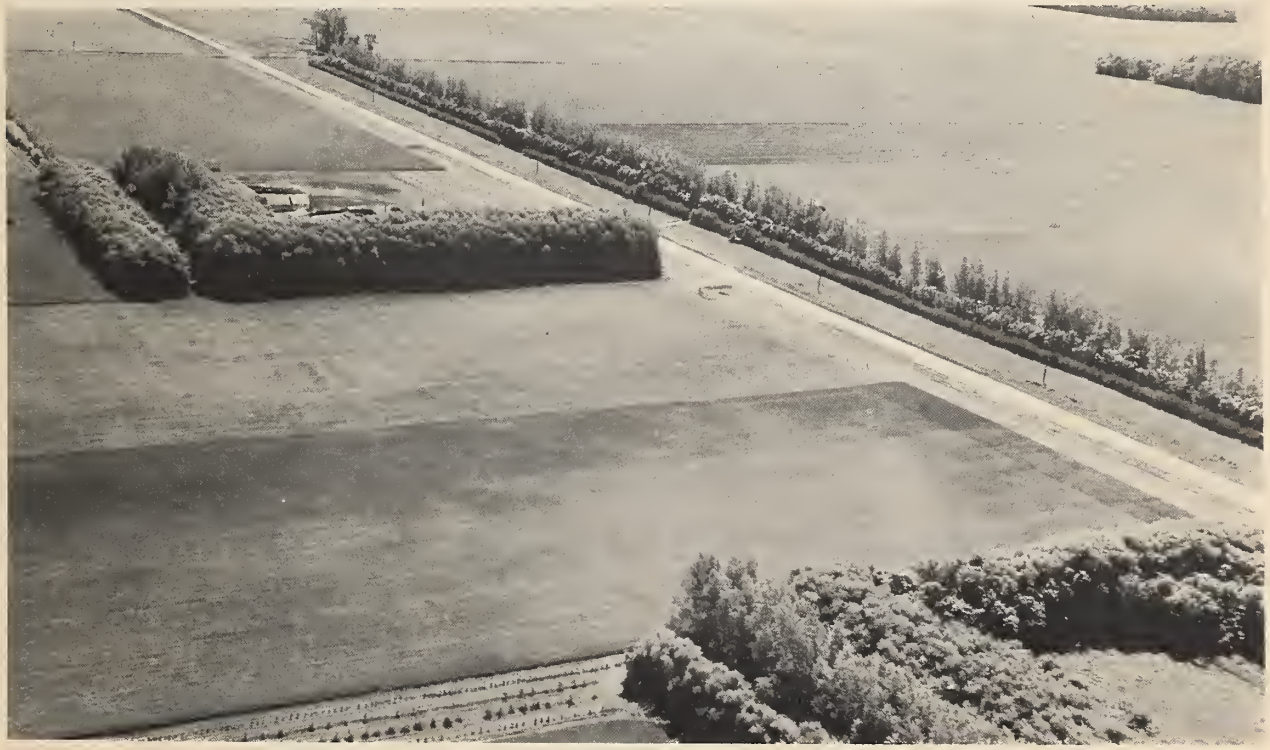
In the northern Plains, the added moisture from snowdrifts on the leeward side of windbreaks may help in the production of a good crop during dry seasons.

In orchards and gardens

Orchards need shelter against high winds, especially during pollination and when the fruit is ripening. Fruit is often blown off the trees in unprotected orchards or is bruised and scarred.

Citrus fruits are easily damaged by hot winds that dry the leaves and fruit. But windbreaks give protection. Windbreak-protected orchards produce both higher yields and higher quality fruit. H. E. Wahlberg of Orange County, Calif., reports data that show that the average return per acre from 20 citrus orchards having windbreak protection was almost double that from 20 unprotected orchards.

Windbreaks help in many ways. Behind a good windbreak you can spray, dust, and prune fruit



ND–710

Aerial view of young and mature windbreaks in eastern North Dakota.

CAL–3917

California citrus growers use eucalyptus tree windbreaks to protect their orchards. Yields are higher and fruit quality is improved.

FLA–D28–

Windbreak of casuarina (Australian-pine) about 60 feet high shelters this Florida orchard.

trees easier. Honeybees and other pollinating insects are more effective when sheltered against winds. Irrigation evaporation is reduced. Clean-cultivated orchards are protected from wind erosion. In the North, properly located windbreaks trap snow, adding more moisture for fruit production.

Vegetable gardens and small family orchards also benefit from properly designed windbreaks. In snow country, many farmers plant their gardens and berry crops between the windbreak and buildings to get additional moisture from melting snow.

To protect livestock

Livestock do better when protected from wintry winds and snow. Good windbreaks help to provide part of the needed shelter by reducing wind velocity and trapping snow. (See Planning Windbreaks for Livestock Shelter, p. 15.)

Many ranchers are planting windbreaks to protect their cattle and sheep from blizzards and cold driving rains. They find that livestock winter well behind the shelter of windbreaks. Not only do they need less feed, but their gains are higher. Calving and lambing are less risky. Dairy farmers find that milk cows produce more milk on less feed and are more comfortable in the lee of a good windbreak.

The Montana Experiment Station, Havre, Mont., found that a herd of cattle protected by windbreaks gained 35 pounds more each during a mild winter and lost 10½ pounds less during a severe winter than an unprotected herd.

For wildlife habitats

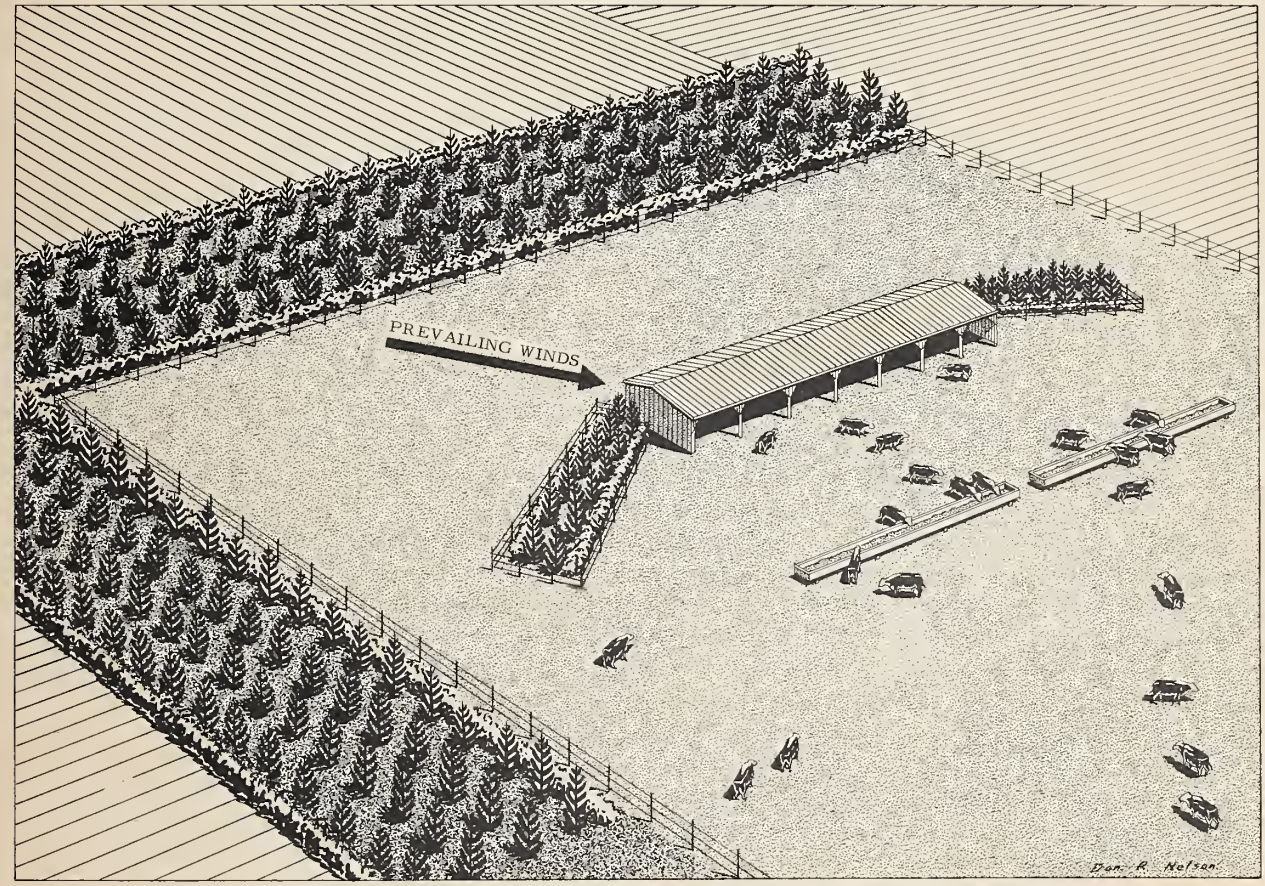
Windbreaks make valuable cover and nesting areas for upland game and songbirds. In summer these windbreaks provide homes close to cropland for insect-eating birds. In Texas, a half-mile field windbreak examined by biologists had 25 occupied bird nests and was sheltering a covey of quail. The

MD–30,317

Birds eat the fruits of many shrubs. The red berries of this autumn olive provide food into the winter months.

NEB–207

This wide, dense Nebraska windbreak protects cattle from snow and raw wintry blasts.



A windbreak of trees and shrubs protects cattle and barn. Most of the snow is trapped within the trees. Plantings next to the barn catch snow during severe storms and keep it from eddying into the barn.

biologists estimated that this bird population would consume about 260 pounds of insects during the year. In winter, when all other food is blanketed with snow, seeds and fruits of the tree and shrub windbreaks provide food for nonmigratory birds.

To be of greatest value to wildlife, a windbreak should include at least one or more rows of dense, low-growing shrubs or evergreens, or both. Where blizzards are common, make the windbreak wide and space the plants so that the windbreak traps most of the snow, leaving for wildlife cover the trees and shrubs on the leeward side where little snow blows through or accumulates.

Certain shrubs and trees are better than others for wildlife. Low-branching evergreens are excellent. So are autumn olive, Russian-olive, aromatic sumac or skunkbush, buffaloberry, wild plum, honeysuckle, hawthorn, privet, and chokecherry. Others may be hardy and useful in your area. Choose only those best adapted to your climate and soil.

Hunters like field windbreaks and field hedgerows. This is often where they find game birds and other game.

State game department officials, SCS specialists working through locally organized soil and water conservation districts, and others are available to help you plan your windbreak to make it better for wildlife.

MINN–1816

This Minnesota spruce windbreak shelters a male dove feeding fledglings in the nest.

ND–769

A living snow fence holds snow off the highway.

As living snow fences

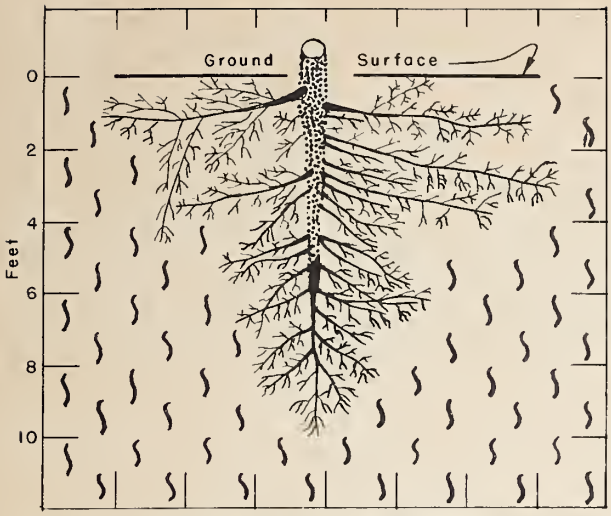
In snow country, properly located living fences of trees and shrubs parallel to your driveway or to highways help to hold the snow on the fields and off the roads. For this reason, county commissioners and highway departments encourage the planting of trees for snow fences.

Leave at least 125 to 150 feet between the windbreak and the road whether the windbreak is to the north, south, east, or west. Because winds blow from every direction sometime during the winter months, this is advisable so that drifting snow will not block the road. Also trees too close to a road may shade it and cause icy conditions. The area between the windbreak and road can be planted to crops or grasses that benefit most from the additional moisture from melting snowdrifts.

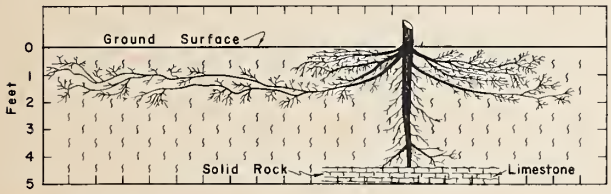
The snow fence may also protect adjoining fields and be a part of your field-windbreak pattern. In some areas, such as the Red River Valley of North Dakota and Minnesota, living snow fences keep snow and drifting soil out of cropland drainage ditches.

Soils and Windbreak Growth

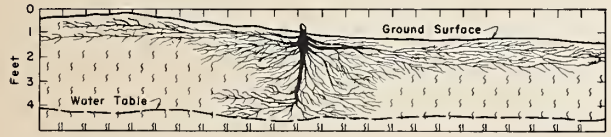
All species of trees and shrubs do not grow at the same rate nor do they grow to the same mature height. Likewise, adapted species vary in their growth on different soils within a geographical area.



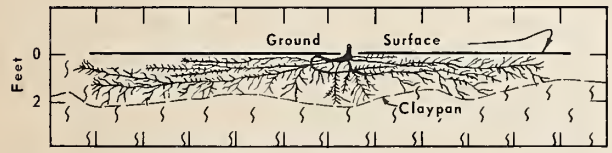
A good loam soil allows moisture penetration and deep, uniform distribution of tree roots.



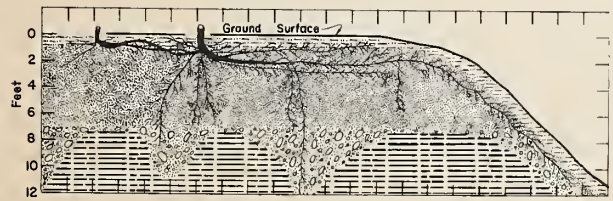
These tree roots could not grow any deeper because of the solid rock.



A high water table prevents deep root penetration. These roots stopped at 4 feet. Tree roots must have air to grow.



The claypan soil restricted the roots of this tree to 2 feet in depth.



Tree roots follow moist sand and gravel pockets.

The amount of available soil moisture during the growing season and soil aeration are two important factors affecting tree growth. These are largely determined by soil texture and depth and by climate.

On deep, fertile, well-drained sandy or silt loam soils without hardpans and with adequate available water, all species grow well. These soils allow extensive root penetration and provide all the essentials for good tree growth.

Only a few species of trees can tolerate saline, alkali, or very acid soils. Some trees grow fairly well on shallow soils for a short time, then grow slowly or stop growing and die. Disease problems also multiply on these soils.

Trees make only fair to poor growth on poorly drained clayey soils. They are less porous, have a slower water-infiltration rate, and are subject to runoff. They can store considerable soil moisture but much of it is not available to plants. Aeration is poorer, root systems are shallower, and tillage is more difficult than in sandy or silt loam soils.

Recent studies by the author on windbreak growth in a central Plains county, following a 5-year drought, show that all adapted species were growing well on deep sandy loams and on soils that have a stable water table. In 20 years, cottonwood had grown to 60 feet; Siberian elm, 50 feet; ash and hackberry, 35 feet; bur oak and Osage-orange, 25 feet; and ponderosa pine and eastern redcedar, 20 to 25 feet. In adjacent windbreaks on clay soil, only Siberian elm, oak, Osage-orange, pine, and redcedar

MINN–1817

A single-row windbreak of poplar trees and shrubs is growing on deep, fertile soil in Minnesota.

survived, but vigor was only fair and growth was about one-third less than that on deep sandy loams. On very sandy soils, only pine and redcedar survived and growth was poor.

Since 1951, teams of SCS soil scientists and foresters have studied soils and windbreaks to determine windbreak growth on different soils. They carefully described the soils, took measurements of tree height and age, and observed general vigor and condition of the trees. If available, this information has been included in published soil surveys.

The following table, abstracted from the published soil survey for Reno County, Kans., shows the kind of information that is available in published

Suitability of some adapted trees for windbreaks and their estimated height at 20 years of age on soils of five different soil groups

(Abstracted from table 3, Soil Survey, Reno County, Kans., 1966)

[Measurements of height are not generally shown for soils rated poor]

Windbreak suitability group	Eastern redcedar	Ponderosa pine	Green ash	Cotton-wood	Siberian elm (Chinese)	Hack-berry	Russian-olive
Group 1: Clayey soils that are poorly aerated and have poor soil-moisture relationships. (Examples are Smolan silty clay loam, 1 to 3 percent slopes, and Tabler clay loam.)	Excellent (22 feet).	Fair to good (17 feet).	Poor.....	Poor.....	Fair (25 feet).	Poor.....	Poor.
Group 2: Loamy soils that are fairly well aerated and have fair soil-moisture relationships. (Examples are Bethany silt loam, 0 to 1 percent slopes, and Farnum fine sandy loam, 0 to 1 percent slopes.)	Excellent (25 feet).	Fair to good (19 feet).	Poor.....	Poor.....	Good (44 feet).	Good (22 feet).	Poor.
Group 3: Fine sandy loams that have a clayey subsoil. (Examples are Carwile fine sandy loam and Pratt-Carwile complex (Carwile soil only).)	Excellent (25 feet).	Fair to good (25 feet).	Good (28 feet).	Good (53 feet).	Excellent (46 feet).	Good (25 feet).	Poor.
Group 4: Soils that have a surface layer and subsoil of loamy fine sand to clay loam and that generally are well drained or moderately well drained. (Examples are Clark fine sandy loam and Naron fine sandy loam, 0 to 1 percent slopes.)	Excellent (24 feet).	Good (25 feet).	Fair (26 feet).	Fair (40 feet).	Good (44 feet).	Good (27 feet).	Fair (18 feet).
Group 5: Deep sandy loams and loamy fine sands that are mainly well drained or somewhat excessively drained. (Examples are Pratt loamy fine sand, undulating, and Pratt loamy fine sand, hummocky.)	Excellent (19 feet).	Good (26 feet).	Fair (22 feet).	Poor to good (45 feet).	Fair (36 feet).	Fair (18 feet).	Fair (15 feet).

KAN–2001

The uneven skyline of this Kansas windbreak reflects the soil depths in which the trees are growing. Studies show that kind and depth of soil affect survival and growth of tree species.

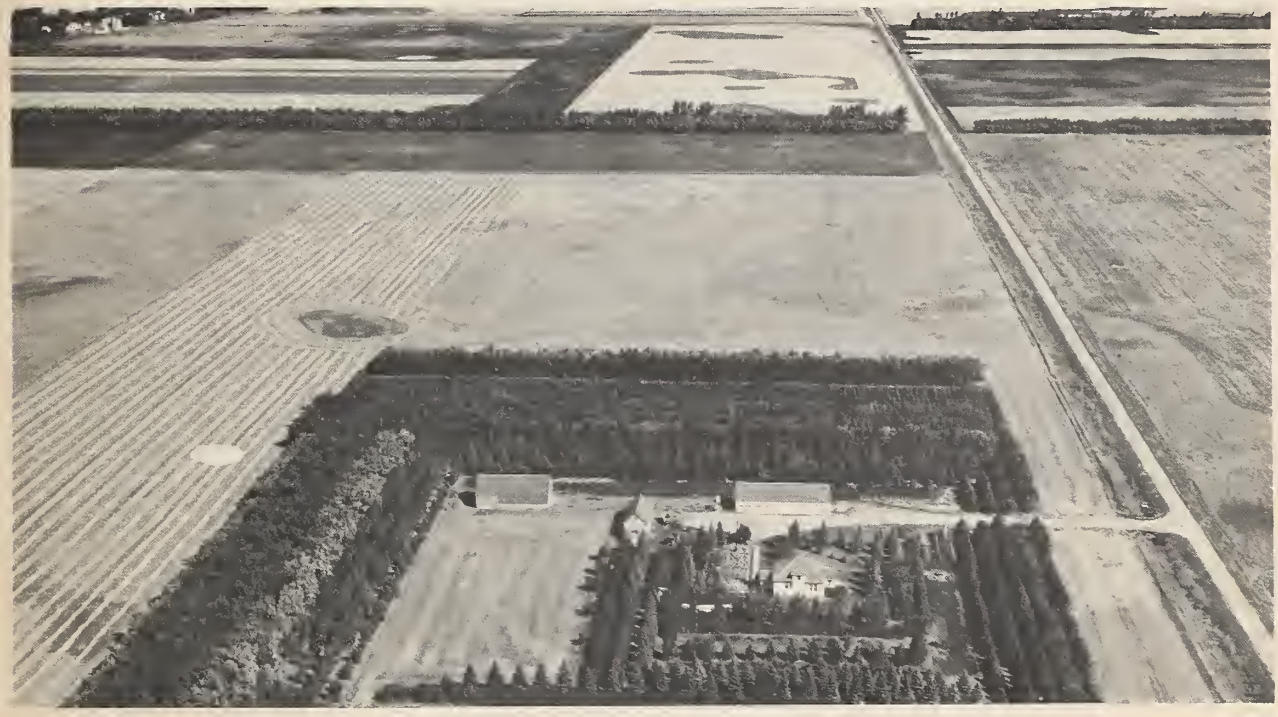
soil surveys and in most SCS offices located in areas where windbreaks are commonly planted. A knowledge of the soils in different windbreak suitability groups and of the growth that can be expected for different trees on these soils helps in determining the kind of trees to plant. The soils are grouped in windbreak suitability groups according to their physical characteristics. For example, group 1 includes clayey soils that are poorly aerated and have poor soil-moisture relationships. In contrast, group 4 includes soils that have a surface layer and subsoil of loamy fine sand to clay loam and that generally are well drained or moderately well drained.

Planning Windbreaks

Windbreaks for your home or farmstead, fields, or livestock shelter should be planned carefully. A single windbreak or a windbreak system is an important part of your complete soil and water conservation plan. This plan, usually made with SCS assistance, is a record of all the conservation practices that you need.

For farmstead and home

The location and layout of your farmstead or country-home windbreak should be considered with



ND–771

This North Dakota farmstead is well protected from wind and snow by a windbreak of evergreen trees, fruit trees, and colorful shrubs. Stripcropping and field windbreaks in the background protect the soil.

NEB–2170

This couple is harvesting bush cherries for the home table from their windbreak—another windbreak value.

ORE–75,035

A one-row Oregon windbreak of native Port Orford cedar. In areas formerly in forests, windbreaks can easily be grown.

care, or it may become a hazard rather than a benefit.

Where snowdrifting or soil blowing is a big problem, give a lot of thought to where you place your windbreak plantings in relation to the main buildings, yard, and driveways. Since the windbreak will be there a long time, it pays to lay it out right in the beginning. Many homeowners change fences, driveways, and feedlots to get the most advantage from their windbreak.

Your farmhouse may be so close to the road that you do not have room for a good windbreak. Or you may have room for only a few rows. If so, consider planting on the other side of the road. In the North, however, make sure you plant back far enough so that snowdrifts do not block the road. Leave room for a windbreak when building a new home.

You get the most protection from your windbreak by locating it against the prevailing winds so that it protects two or three sides of your farmstead. Wind and snow whip around the ends of a windbreak, so make the windbreak long enough—extend it at both ends at least 100 feet beyond the area to be protected. And run lanes or roads at an angle through it.

Leave 100 to 150 feet between the windbreak and the main buildings and yard. At this distance you will get adequate protection from winds, and you should not be troubled with snow in the yard. If possible, place the windbreak no more than 300 feet from your home. If your land is sloping, plant on the contour if practicable. In low-rainfall areas, divert water into the windbreak from an adjoining field or road ditch. Avoid planting on old feedlot

ND–791

A wind barrier of trees and shrubs protects and beautifies this attractive country home.

ND–580

This young farmstead windbreak planted on the contour shows good planning and layout. It will give protection against winter winds and drifting snow.

areas since trees do not grow well on such sites.

If you have an old windbreak or one that is too open at the bottom, you can improve it by planting another three to five rows of trees and shrubs to the windward side. A colorful shrub or evergreen row can be added to the leeward side. Or you may want to plant a whole new windbreak—either to the windward or leeward, depending on space. When the new windbreak grows up, you can remove the old one or leave it for additional wildlife cover.

In the North a windbreak for a country home should have at least seven rows to give wind protection and to trap most of the snow. Species used should give year-round protection, provide a barrier uniformly dense from the ground line to the top, and have a reasonably long life.

In the South and other areas where snowdrifting is no problem, a few rows may be all you need for the home windbreak. Evergreens (conifers) are always preferred for winter protection. But if you want only summer protection, plant a few rows of broadleaf (deciduous) trees to screen the hot winds. A windbreak that is too dense may cause air stagnation and increase temperatures in the yard.

Additional plantings are often desirable for screening, hedges, shade, and beautification.

COLO–11279

A section of a Colorado farmer's 50-year-old pine windbreak was thinned and pruned to provide this recreational area

ND–788

Corn strips planted to protect summer fallow land against soil blowing will be left for winter wildlife food. These strips and the tree windbreaks in background are a good combination of measures for wind-erosion control.

ND–788

This Siberian elm row protects soil and crops and helps to hold and distribute snow in the field. With proper pruning and thinning, this windbreak will do a better job of distributing snow uniformly during severe blizzards.

MONT–317

Single-row Russian-olive windbreaks spaced 5 rods apart protect these Montana fields.

For fields

Field windbreaks should be laid out at right angles to prevailing damaging winds. Usually, they consist of one or more rows of trees placed along the windward side of a field with additional parallel windbreaks through the field. The distance between them should be about 10 times the height of mature trees.

In some localities, damaging winds come from several directions. Then isolated one-direction windbreaks are of little value. A pattern of windbreaks forming squares or two-direction combinations rather than parallel strips is needed to give protection.

Windbreaks reduce wind velocity to a practical degree for a distance of about 10 times the height of the trees. Thus a windbreak 30 feet high gives protection to a strip about 300 feet wide when the wind direction is at right angles to it. Some protection is provided for a distance of 20 to 25 times the height of the trees. If you know about how tall your trees will grow, you can tell how far apart to place the windbreaks. Should you want to space the windbreaks farther apart, other factors such as soil texture, climate, crop residues, and soil roughness must be known to design an effective wind-erosion-control system.

Your field windbreaks should follow the contour in sloping fields if the slope is generally at right angles to damaging winds. If other measures such as terraces or an irrigation system are needed, they should be planned and laid out at the same time as the field windbreaks. Since the windbreak should be generally at right angles to the damaging winds, it may not always be necessary to plant the entire length of a contoured field.

Windbreaks in the right place may keep your irrigation and drainage ditches from filling with windblown soil. But some species planted too close to main irrigation or drainage ditches may clog the channel with spreading roots.

Avoid creating blind corners when planting windbreaks next to highways; they are a safety hazard. Also consider present and future telephone and electric lines when deciding where to locate your windbreak.

Some alternative measures you can use in combating wind erosion are barriers of annual plants such as rye, corn, sorghum, or sunflowers, and cover crops such as oats or rye.

It will pay you to get the local SCS conservationist or someone who understands conservation problems to help you plan your wind-erosion-control system. After you get all the facts about your soil and the kind of protection needed, you can decide

how many field windbreaks are needed and where they should be located.

In summary, things to consider in planning field windbreaks include climate and wind, soil texture, soil roughness, size of fields, how high windbreak trees will grow, crop residues left on the surface, kinds of crops to be grown, annual cost of installing and maintaining the protective measures, and the potential monetary returns and other benefits.

For livestock shelter

In range country where blizzards are a hazard, many ranchers plant tree shelters to protect their livestock, to trap snow, and to reduce the chilling effects of wintry winds.

Fifteen to twenty rows of trees, preferably evergreens, are needed in the North. Fewer rows may be ample further south. Feed supplies and water are placed so that they are away from the wind during stormy periods. Plantings are usually made in the shape of an L, U, or E design.

Where livestock are winter quartered at a farm-

MICH–61060

Rows of barley protect lettuce seedlings on muck soils in Michigan. The barley is cultivated out when the lettuce no longer needs protection.

GA–D14–129

These rye strips protect cotton seedlings against blowout and soil-particle abrasion.

SD–753

A young windbreak shelters cattle from drifting snow. Its value will increase as the trees mature.

stead in the North and where blizzards are common, the windbreak should have from 10 to 15 rows of trees. From 100 to 150 feet should be left between the leeward side of the windbreak and the sheds, barns, and feeding area.

Establishing Windbreaks

What kind of trees and shrubs to plant

Many kinds of evergreen and broadleaf trees and shrubs are suitable for windbreaks. There are tall, medium tall, dense, and low-growing trees that can be used singly, together, or in combination with shrubs. Some are fast growing and short lived, others grow more slowly and live longer.

The important thing is to choose the species that are best suited to your soil, that have proved hardy in your area, and that provide the kind of windbreak you want. Your site may have a wet area, a stony knoll, or some other unfavorable condition. Unless you choose species that grow under the unfavorable condition, you may have gaps or holes in your windbreak. Use species that will give as much height as the soil and available moisture will support when the trees are full grown.

Evergreens such as spruce, pine, cedar, and juniper are excellent for windbreaks. They give year-round protection and are usually long lived. Where they grow fairly fast and survival is good, the entire windbreak may be evergreens.

Where evergreens grow more slowly or are hard to get started, broadleafs, such as elm and ash, and honeysuckle may be used along with evergreens to get protection as early as possible. Broadleafs usually grow faster and give earlier protection than evergreens but do not live as long. In the meantime the evergreens grow and continue to give protection after the broadleafs die out.

Some species of trees and shrubs spread to areas where they interfere with cultivation or other farm-

WN–217

Test plantings of trees and shrubs at the Soil Conservation Service Plant Materials Center, Pullman, Wash. Research stations and plant material centers countrywide test many species to find out their suitability to various soils and climates.

ing operations. It is a good idea to consult your local forester or SCS conservationist for recommendations on the best species to plant.

Where to plant

If an evergreen row is to be planted next to a broadleaf row, make sure the broadleafs do not interfere with the growth of the evergreens. Use a slow-growing broadleaf variety next to the evergreens or leave additional space between the evergreen and broadleaf rows. At maturity the trees in one row should not overtop or suppress the ones in a neighboring row. Shrubs are often used to increase density near the ground line and to help trap snow within the windbreak.

In some parts of the country, evergreen rows are preferred on the leeward side of the windbreak; in others, on the windward side. The deciding factor should be the amount of tree breakage expected from melting snowdrifts or the amount of sunlight that each species requires. It is best to follow the arrangement common in your area.

N MEX–13,723

A one-row irrigated windbreak of Arizona cypress.

MINN–1759

A Minnesota farmstead windbreak of evergreens and broadleaf trees and shrubs. Evergreens are on the leeward side. The snow trap on the left holds most of the snow.

How to space

Plan for adequate spacing between rows in the windbreak. In areas of plentiful moisture, 10 to 15 feet between rows is best; in dry areas, as much as 18 feet or more may be needed for best growth. Allow enough space between the rows to cultivate with available farm cultivators and lay out the corners of the planting so the equipment can make the turns.

With wide spacing, cultivate for the life of the planting to prevent weed competition for moisture. It is advisable to keep a strip at least a rod wide around the outside of the windbreak in clean cultivation.

Regardless of the spacing between windbreak rows—for home or farmstead, livestock, or wildlife plantings—space the plants close together within the row. Spacing distances vary in different parts of the country. Consult your local SCS conservationist, county agent, or forester for recommended spacing in your area.

SD-715

The old tree barrier on the left was not wide or dense enough to trap and hold the snow during a severe blizzard. The buildings are too close to the trees. New rows of trees and shrubs to the windward side of the old trees would help.

How wide and dense to make them

The kind of protection you want should determine in part the number of rows and the density of the windbreak planting. The amount and extent of wind reduction depend on density, width, height, length, cross-sectional shape, and continuity of the windbreak. If you want maximum protection at ground level, plant more shrubs or dense-growing evergreens; if you wish to protect large cultivated fields with the fewest windbreaks, use tall trees and shrubs; if you want wildlife, plant wide windbreaks of the shrubs and evergreens most favorable as wildlife habitat; and if you want windbreaks only to trap snow for road protection, one- or two-row plantings of dense low-branching species may do the job.

NEB-184-

As trees grow older their shape and density may change. The addition of three rows of redcedar planted on the windward side of older American elm will trap snow in the older trees and increase their windbreak density.

In irrigated areas and also where rainfall is favorable, a one- or two-row planting may be adequate for field windbreaks. On the other hand, where tree growing is more difficult, such as in the Plains, a three- to five-row planting is better. But, even here, one- and two-row windbreaks can be effective where soil and rainfall are favorable and other conservation practices are used.

Since field windbreaks generally do not need to reduce wind currents to the same degree as windbreaks for the home, they can be narrower and less dense. Part of the wind currents can blow through and still not damage crops or start soil blowing. A windbreak that is partly open near the ground dissipates the wind to a greater distance leeward and helps to avoid eddying effects.

In snow country it is desirable to have a large part of the snow blow through the windbreaks onto the fields. If this is the primary purpose, a one-row barrier, widely spaced, is best.

Windbreaks for commercial orchards, truck gardens, and specialty crops are usually one row. For orchard protection, it is desirable to plant a species that leaves the bottom open to permit air drainage.

For farmsteads and country homes, livestock shelter, and wildlife habitat, windbreaks need to be wider and denser than for fields and crops—usually in the five- to seven-row range.

ND–714

People in a North Dakota village planted these protective windbreaks for community benefit. The 10-row planting includes evergreens and colorful shrubs.

FLA–D28–13

Narrow windbreaks protect these Florida citrus groves.

NEB–217

A grain sorghum cover crop protects this 4-year-old redcedar windbreak. The Nebraska owner has planted a similar cover crop for several years to hold snow for additional moisture, to prevent wind erosion within the young planting, and to lessen soil-particle abrasion of the young tender seedlings.

How to prepare the land

It is always best to stake out your windbreak before you prepare the land, making certain that it has the right width and length and that it is located in the right place.

Prepare the land well ahead of planting. The windbreak plots should be fallowed at least 1 year in dryland areas. Fallowing stores up moisture and helps to control weed growth in later years. If you have the equipment to do the job, leave the stubble on the surface. Sod should be broken and worked thoroughly.

Where rainfall is adequate and in irrigated areas, deep fall plowing is best on loam or silt loam soils.

If your land is infested with grass or perennial weeds, kill them before planting the trees. Do this by fallowing or by growing a row crop the year before you plant the trees. Good land preparation pays big dividends in increased tree growth and fewer weeds.

It is best to leave some grain stubble or plant a cover crop on cultivated soils that are likely to blow. Do not fall plow. Several weeks before tree-planting time, plow out strips wide enough for the tree rows. This gives the soil time to settle a bit. The same applies to sandy grassland where it is not safe to plow up the whole area. Where listing is common, some farmers prefer to plant seedlings in lister rows.

Where moisture is short or where the soil is apt to blow, plant strips of tall-growing plants, such as corn, sorghum, or millet. Plant one or two rows the year before you plant the trees and keep them cultivated. These strips protect the soil against blowing and catch snow during winter, thus adding moisture for the tree seedlings.

How to choose seedlings

Get seedlings grown in a nursery in your area or from an area having a similar climate. State or private nurseries in your own state usually grow the best seedlings for your windbreak. Your county agent, local forester, or SCS conservationist can help you contact a suitable one. You may want to order extra seedlings with the first order to replace dead ones the next season.

Good quality, graded, vigorous seedlings are best. Though they may cost a trifle more, the extra cost is small compared with the total cost of a windbreak.

Choose the size carefully. Seedlings that are either too small or too large usually don't grow well. Seedlings of broadleafs should be about 18 to 36 inches in stem length. These are 1- or 2-year-old seedlings. They should measure about $\frac{3}{16}$ to $\frac{3}{8}$ inch about 1 inch above the root collar. The root system should be well branched, from 8 to 9 inches long, and in balance with the stem. Larger seedlings cost more and ordinarily do not do as well as the 18- to 36-inch ones.

Evergreen seedlings should be 8 to 12 inches high and have a well-balanced and fibrous root system.

KAN–2002

Kansas vo-ag high school students provide a valuable service by potting redcedar seedlings. They will be grown in pots for a year, then sold to farmers for windbreak plantings. Potted evergreens insure much better survival.

Get the grade and age recommended for your area.

Evergreen survival in dry, windy areas is often poor. Drying winds and hot temperatures kill or severely damage the stems before the root system can start working. Some nurseries offer potted evergreen plants at a reasonable cost. Though the cost is higher than for bare-rooted seedlings, these plants insure much better survival.

Heeling-in bed.

How to plant seedlings

When the seedlings arrive, open the nursery bales and check the plants for heating, molding, or dryness. If they are satisfactory, wet the roots, store them carefully in a cool shady place with roots protected, and plant within a few days.

If you cannot plant immediately, dig a trench about a foot deep and bury the seedling roots in soil, leaving the tops out. This is called "heeling-in." Pack the soil firmly, water thoroughly, and make certain that no roots are exposed.

Evergreens require extreme care. Do not expose the roots to the air for more than a few seconds. When heeling-in evergreens, split the small bundles and spread out the seedlings in a trench to make sure that the root system of each seedling is protected by soil.

Plant the seedlings at the best time for your locality. Most planting is done in the spring, but, if local conditions permit, it may be done in the fall.

It is best to get your seedlings at the time you plan to plant.

Many soil conservation districts and some state forestry or game departments provide mechanical tree planters. Trained planting crews are often available locally.

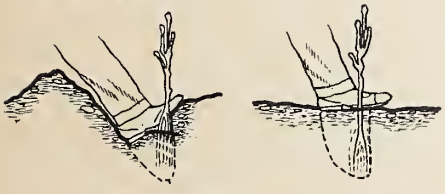
If you hand plant, stake out the rows according to your planting plan. Plant the trees in straight rows or on the contour to make cultivating easier.

A good planting job insures better survival. Avoid a hot, windy day. After the windbreak is planted, water if the weather turns hot and windy. Shingles or burlap strips staked on the windward side to shade and protect the evergreens may increase survival.

Replace dead trees and shrubs the following year with seedlings of the same species. A gap in your windbreak is like a hole in a fence.

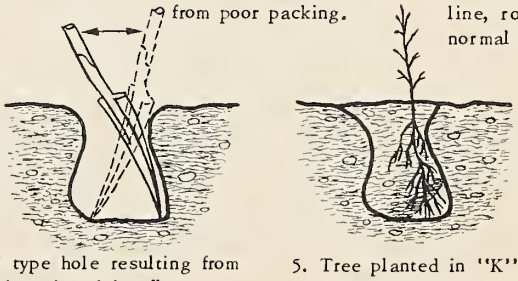
Scrape dry soil from surface.
Reverse shovel and push into soil.

Push handle ahead. Scrape soil back to enlarge hole.



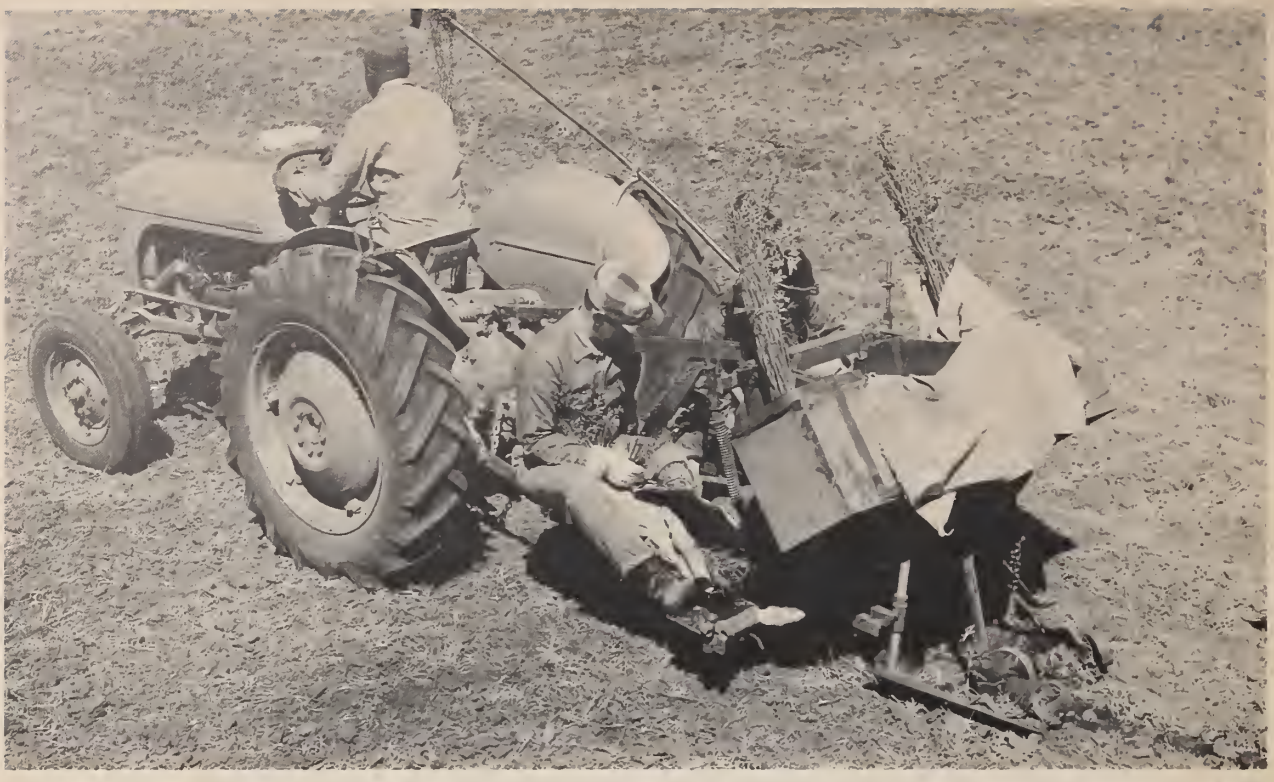
Fill in and tamp tight.

1. Good hole–tree too deep.
2. Good hole–air space at bottom resulting from poor packing.
3. Shallow hole, root collar above ground line, roots not in normal position.



4. "K" type hole resulting from pumping shovel handle.
5. Tree planted in "K" hole, air space in bottom of hole.

(Left) Planting with a shovel; (right) pointers on setting seedlings.



SD—545

Many soil conservation districts own and operate mechanical tree planters for the benefit of their cooperators.

Managing Windbreaks

Even where trees grow naturally, and where forests once grew, such as in the Northeast or the South, your windbreaks should receive some care right after planting. And after they are well started, keep out fire, insects, and livestock. Replant spot or row failures the following season. Later the trees may require thinning.

On grassland soils, such as in the Plains, it is necessary to tend trees as you would field crops. They must be cultivated, weeds and grass kept out, insects controlled, and water conserved or diverted to their use. Here, too, row or spot failures must be replanted. Later, additional shrub or evergreen rows may be needed to maintain density.

Trees change in character as time passes. Some species thicken up, others thin out, while still others may lose their lower branches. It may be necessary to thin some rows to keep the number of trees in balance with the available moisture. Some cutting and pruning may be needed to keep an adjacent broadleaf row from damaging evergreens. In windbreaks overrun with weeds and grass, vigor and usefulness may be restored by removing partial row failures, destroying the grass and weeds, and replanting. For best growth and long life, windbreak trees need the best care you can give them.

Protecting from livestock

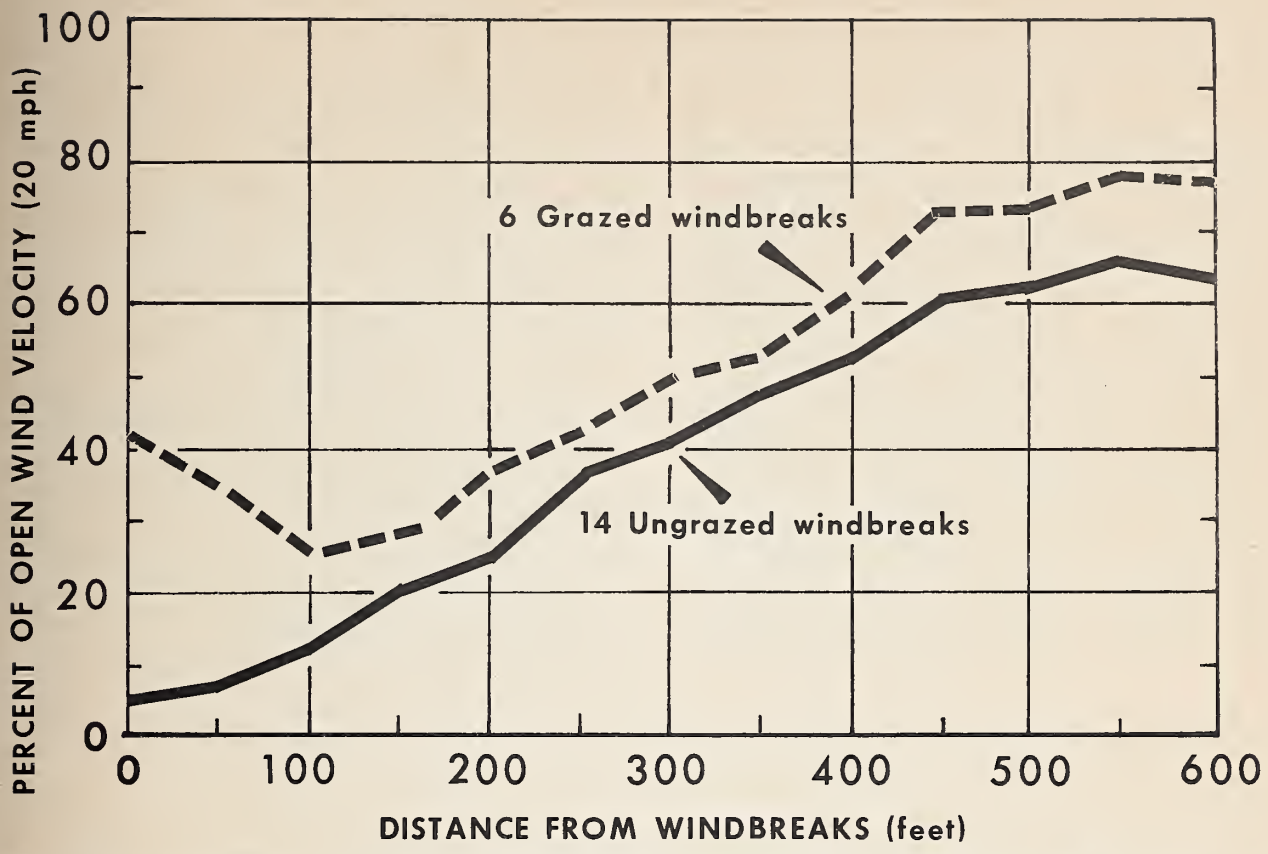
Livestock must be kept out of windbreaks. This is true regardless of the age of the trees. Livestock browse the leaves, break off branches, compact the soil, and open up the lower parts of the windbreak. Weeds and grass creep in and the windbreak becomes less effective. Outside of fire, there is no surer way of ruining a windbreak.

When the windbreak is young, poultry should also be kept out. They eat the tender buds.

If you need a fence to keep livestock out, do not crowd it in too close to the trees. Allow ample feeding space for the tree roots and room for cultivating. A cultivated strip next to the windbreak serves as a firebreak, keeps grass and weeds from creeping in, and lets the soil take in water more readily.

Controlling weeds and grass

After planting, no single management practice is more important in growing young windbreaks than controlling competing weeds and grass. Competition for moisture and nutrients usually results in less growth and vigor or in a complete windbreak failure. Even where there is plenty of moisture, trees and shrubs do better when weeds and grass are controlled.



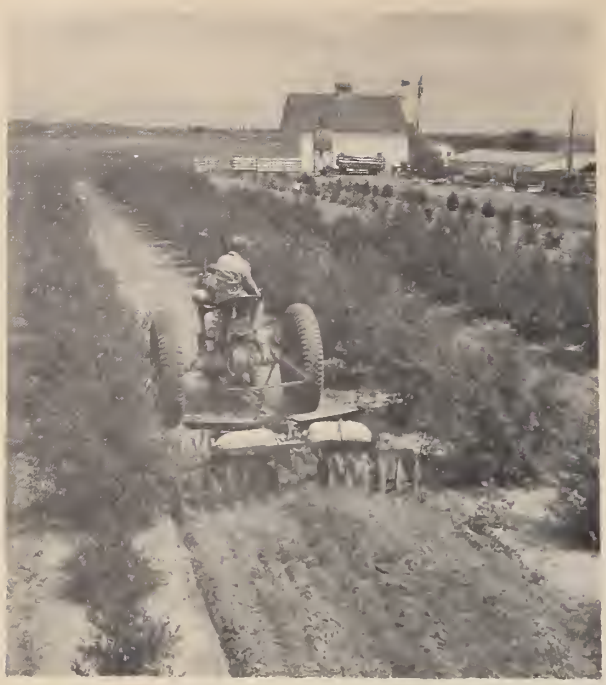
This chart shows the difference in protection provided by grazed and ungrazed windbreaks at given distances from the windbreaks. The greatest difference was recorded at less than 50 feet from the windbreaks. During the tests, open wind velocity on the leeward side of the windbreaks averaged 20 mph. At less than 50 feet from the grazed windbreaks, wind velocity was reduced to 40 percent of open wind velocity, or 8 mph; whereas, at the same distance from the ungrazed windbreak, it was reduced to 8 percent of open wind velocity, or 1.6 mph. Twenty South Dakota windbreaks in full foliage were used in the tests. They were 10 rows wide and averaged 35 feet in height. Cattle and sheep had destroyed the shrub rows and most of the lower tree branches in the six grazed windbreaks.

ND–790

The tractor-mounted tine attachment on the right destroys young weeds growing in the tree row; the field cultivator controls weeds adjacent to the tree rows.

COLO–11192

In this eastern Colorado farmstead windbreak the tree rows are widely spaced and weeds are controlled to increase tree growth and prolong the life of this outstanding windbreak.



NEB–1549

A clean windbreak is necessary. It leaves all the moisture for the trees.

FS–503717

A backpack sprayer is used to apply a herbicide to control weeds.

NEB–2169

This nine-row Nebraska windbreak has been treated with a herbicide to control weeds in the tree row. Ordinary cultivating equipment controls weeds between the rows.

You can control them with machinery or with herbicides.

A sweep-type cultivator, spring-tooth harrow, or a tandem disk can be used to kill weeds between tree rows. Until the trees are too large, a simple flexible-tine unit can be used for timely over-the-row cultivation to kill young weed seedlings within the planted rows. Some hand hoeing may be necessary. Try to keep the land level and do not ridge the rows. Leave the surface in a rough condition for erosion control and moisture absorption.

Shallow cultivation is best—4 to 5 inches is deep enough. You may damage roots if you cultivate deeper.

Cultivate for as many years as you can—until the tree branches close in. In dry areas, or on unfavorable soil, cultivate for the life of the windbreak. Keep an outside strip next to the windbreak clean—it will make the trees grow faster and prolong their life.

In the North, cultivate the last time during late summer. If you cultivate too late in the season, the trees may not harden off and could be injured by an early freeze. If the windbreak area is likely to blow in the winter, leave some late summer weeds or plant a cover crop between the tree rows early enough to make fair growth before winter. This protects the seedlings and in snow country helps to trap snow for more moisture.

Preemergence herbicides control annual weeds and grasses easily and cheaply when applied according to directions. Caution must be used since some plant species are more sensitive than others to herbicides. You can apply them with mechanical spray rigs or, for small plantings, with a backpack sprayer. Adjust the nozzle height to spray a 15- to 20-inch swath on each side of the tree row. It is best to confine chemicals to the tree row and cultivate the area between the rows.

You can get information about kinds of herbicides to use, time of spraying, and rates from your local agricultural or forestry agents.

SD–540

A tree row cultivator.

NEB–2168

This pressure sprayer, owned by a Nebraska soil conservation district, is applying a weed-control chemical on newly planted redcedar.

Mulching

Mulching with hay or straw in place of cultivation is unsatisfactory in areas of dryland farming.

Where rainfall is good and in irrigated areas, mulching with seed-free straw, stalks, or cobs may be satisfactory after the windbreak is at least 5 years old. But cultivation and herbicides are still the best way to keep weeds and grass under control.

Where water erosion is a problem in the windbreak, spread a light mulch once a year as long as it is needed. If it is a bad problem, consult your local SCS conservationist.

SD—553

A forester examines this 20-year-old cottonwood windbreak to determine thinning needs.

Irrigating

Irrigate windbreaks much the same as you do deep-rooted farm crops. One good soaking is better than several light irrigations. In the North, stop watering about a month before the first frost to give the trees a chance to harden off before freeze-up. If irrigation water is available after the leaves drop, give the windbreak a soaking just before the ground freezes. A good soaking is especially helpful to evergreens.

Protecting from fire, rodents, and sprays

For protection against fire in the windbreak, keep a strip around the windbreak free of weeds and grass.

Rabbits and mice often damage young windbreaks, especially during winter. Several good rabbit repellants and mouse poisons are available from seed houses and nursery stores. Reduce rodent damage by keeping out weeds and grass.

Use caution where weeds are controlled in grain crops planted next to windbreaks. Avoid spraying during windy periods to prevent drift—use nonvolatile chemicals. Sprays like 2,4-D often damage trees and shrubs. (See caution, inside front cover.)

Thinning

Multiple-row windbreaks may need thinning or a release cutting after they are 7 to 10 years old to maintain good growth and vigor. Rate of growth, spacing, and related factors determine this need. It is advisable to contact a local forester for advice before thinning.

Sapping and shading

Windbreaks need moisture to live. In dry seasons, tree roots sometimes sap moisture from the crops planted next to them. This problem is most common in the southern Plains.

Many farmers plant an early maturing grain crop next to their windbreaks to avoid this loss. The crop matures before the hot, dry months. Some plant grass instead of grain. Others use the land

MINN—1632

Sapping is not a serious problem where snowdrifts add moisture. Crops are good right up to the tree barrier on this Minnesota farm.

78303

In the southern Plains an early maturing crop, such as the Abruzzi rye shown here, may be planted next to windbreaks to reduce crop losses from sapping. Some grasses do fairly well here too. Tree root pruning will also help.

next to the trees as a turnaround or as a roadway or lane.

Root pruning with a ripper or chisel to about 30 inches deep while the trees are dormant also helps. It is best not to do this when the soil is dry—the trees may be severely injured. Results will be better if root pruning is started when the trees are 4 to 6 years old.

If the windbreak makes lots of shade, plant a crop that will stand some shade next to it. Use trees and shrubs that will sap the fields the least.

In areas where snowdrifts add moisture, sapping is not so serious. Even here it might be best to use the area next to the trees for a turnaround or put it into an early maturing crop.

Where Is Help Available?

Before you plant a windbreak, get advice from local specialists. Your SCS conservationist can help you with your soil and water conservation plan which should include your windbreak system. The county agent, the farm forester, and, in some states, game department officials are also available to help you. They can tell you where you can get good-quality seedlings. The County Agricultural Stabilization Committee will advise you of any financial help that is available on a conservation cost-sharing basis. In many counties, soil conservation districts rent mechanical tree planters at a reasonable cost.

Common and Scientific Names of Some Trees and Shrubs

Pacific Northwest

Alaska-cedar	*Chamaecyparis nootkatensis*
caragana (Siberian pea-shrub)	*Caragana arborescens*
cedar, incense	*Libocedrus decurrens*
cedar, Port Orford	*Chamaecyparis lawsoniana*
Douglas-fir	*Psedotsuga menziesii*
elm, Siberian (Chinese)	*Ulmus pumila*
hemlock, western	*Tsuga heterophylla*
honeylocust	*Gleditsia triacanthos*
juniper, Rocky Mountain	*Juniperus scopulorum*
laurel, English	*Prunus laurocerasus*
lilac (common)	*Syringa vulgaris*
locust, black	*Robinia pseudocacia*
pine, ponderosa	*Pinus ponderosa*
pine, Scotch	*Pinus sylvestris*
poplars	*Populus* spp.
redcedar, western	*Thuja plicata*
rose, multiflora	*Rosa multiflora*
Russian-olive	*Elaeagnus angustifolia*
spruce, Colorado	*Picea pungens*
spruce, Norway	*Picea excelsa*
spruce, sitka	*Picea sitchensis*
waxmyrtle, Pacific	*Myrica californica*
willows	*Salix* spp.

Southern California

athel (tamarisk)	*Tamarix articulata*
cypress, Arizona	*Cupressus arizonica*
cypress, Monterey	*Cupressus macrocarpa*
eucalyptus	*Eucalyptus* spp.
oleander	*Nerium oleander*

Southern Plains

arborvitae, oriental	*Thuja orientalis*
cypress, Arizona	*Cupressus arizonica*
elm, Chinese (lacebark)	*Ulmus parvifolia*
elm, Siberian (Chinese)	*Ulmus pumila*
hackberry	*Celtis occidentalis*
honeylocust	*Gleditsia triacanthos inermis*
mulberry, Russian	*Morus alba tartarica*
pine, Austrian	*Pinus nigra*
pine, loblolly	*Pinus taeda*
pine, ponderosa	*Pinus ponderosa*
pine, shortleaf	*Pinus echinata*
poplars	*Populus* spp.
redcedar, eastern	*Juniperus virginiana*
sycamore, American	*Platanus occidentalis*

Northern Plains

ash, green	*Fraxinus pennsylvanica*
boxelder	*Acer negundo*
caragana (Siberian pea-shrub)	*Caragana arborescens*
chokecherry, western	*Prunus demissa*
elm, Siberian (Chinese)	*Ulmus pumila*
hackberry	*Celtis occidentalis*
honeysuckle, tatarian	*Lonicera tatarica*
juniper, Rocky Mountain	*Juniperus scopulorum*
lilac (common)	*Syringa vulgaris*

oak, bur	*Quercus macrocarpa*
pine, ponderosa	*Pinus ponderosa*
plum, American	*Prunus americana*
poplars	*Populus* spp.
redcedar, eastern	*Juniperus virginiana*
Russian-olive	*Elaeagnus angustifolia*
spruce, Colorado blue	*Picea pungens*
willows	*Salix* spp.

North Central States

arborvitae, oriental	*Thuja orientalis*
ash, green	*Fraxinus pennsylvanica*
cedar, northern white	*Thuja occidentalis*
elm, Siberian (Chinese)	*Ulmus pumila*
honeysuckle, amur	*Lonicera maacki*
honeysuckle, tatarian	*Lonicera tatarica*
maple, red	*Acer rubrum*
olive, autumn	*Elaeagnus umbellata*
pine, red	*Pinus resinosa*
pine, Scotch	*Pinus sylvestris*
pine, white	*Pinus strobus*
poplars	*Populus* spp.
privet, amur	*Ligustrum amurense*
privet, California	*Ligustrum ovalifolium*
redcedar, eastern	*Juniperus virginiana*
spruce, white	*Picea glauca*
willow	*Salix* spp.

Northeast

hemlock, eastern	*Tsuga canadensis*
honeylocust	*Gleditsia Triacanthos inermis*
honeysuckle, amur	*Lonicera maacki*
honeysuckle, tatarian	*Lonicera tatarica*
olive, autumn	*Elaeagnus umbellata*
pine, red	*Pinus resinosa*
pine, Scotch	*Pinus sylvestris*
pine, white	*Pinus strobus*
privet, amur	*Ligustrum amurense*
privet, California	*Ligustrum ovalifolium*
redcedar, eastern	*Juniperus virginiana*
spruce, Norway	*Picea excelsa*
spruce, white	*Picea glauca*
white-cedar, northern	*Thuja occidentalis*
willow	*Salix* spp.

Southeast and Gulf Coast

arborvitae, oriental	*Thuja orientalis*
bayberry, southern	*Myrica cerifera*
casuarina (Australian-pine)	*Casuarina* spp.
firethorn	*Pyracantha* spp.
honeysuckle, amur	*Lonicera maacki*
laurelcherry, Carolina	*Prunus caroliniana*
olive, autumn	*Elaeagnus umbellata*
photinia	*Photinia* spp.
pine, loblolly	*Pinus taeda*
pine, shortleaf	*Pinus echinata*
pine, slash	*Pinus elliottii*
pine, Virginia	*Pinus virginiana*
poplars	*Populus* spp.
privet	*Ligustrum* spp.
redcedar, eastern	*Juniperus virginiana*

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Tight outside rows of cedar in this farmstead windbreak trap snow and provide good winter cover for wildlife.

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